2010

Trends in Hospital Cost and Revenue, 1994-2005: How Are they Related to HMO Penetration, Concentration, and For-Profit Ownership?

Trends in Hospital Cost and Revenue, 1994–2005: How Are They Related to HMO Penetration, Concentration, and For-Profit Ownership?

Yu-Chu Shen, Vivian Y Wu, and Glenn Melnick

Abstract

Objective

Analyze trends in hospital cost and revenue, as well as price and quantity (1994–2005) as a function of health maintenance organization (HMO) penetration, HMO concentration, and for-profit (FP) HMO market share.

Data

Medicare hospital cost reports, AHA Annual Surveys, HMO data from Interstudy, and other supplemental data.

Study Design

A retrospective study of all short-term, general, nonfederal hospitals in metropolitan statistical areas (MSAs) in the United States from 1994 to 2005, using hospital/MSA fixed-effects translog regression models.

Principal Findings

A 10 percentage point increase in HMO enrollment is associated with 4.1–4.2 percent reduction in costs and revenues in the pre-2000 period but only a 2.1–2.5 percent reduction in the post-2000 period. Hospital revenue in HMO-dominant markets (highly concentrated HMO market and competitive hospital market) is 19–27 percent lower than other types of markets, and the difference is most likely due mainly to lower prices and to a lesser extent lower utilization.

Conclusions

The historical difference of lower spending in high HMO penetration markets compared with low HMO markets narrowed after 2000 and the relative concentration between HMO and hospital markets can substantially influence hospital spending. Additional research is needed to understand how different aspects of these two markets have changed and interacted and how they are causally linked to spending trends.

Keywords: Managed care, ownership, concentration, hospital cost and revenue

With the introduction and growth of managed care, the sustained high growth in United States health care spending subsided for the first time in the 1990s. More recently, however, health spending has accelerated, coinciding with changing market structure and declining health maintenance organization (HMO) enrollment. The empirical literature has not kept up, with only a few studies that document more recent health cost trends and the factors associated with them. The extensive HMO literature on the effects of HMOs mainly focuses on earlier time periods when enrollment was growing (Miller and Luft 1994, 1997, 2002; Morrisey 2001; Scanlon et al. 2006, for reviews) and generally does not differentiate penetration from other factors such as increased HMO market concentration and growth in for-profit (FP) HMO ownership.

Our study explores the relationship between important aspects of HMO market structure and recent trends in hospital cost and revenue growth. We adapt and expand upon multivariate models from the existing HMO penetration literature to include a broader set of market factors that might affect hospital costs and revenues, including measures of HMO penetration, for-profit

ownership, HMO market concentration, and hospital market structure.

CONCEPTUAL FRAMEWORK

In this section, we develop a framework that builds on the existing literature to explore the relationship between HMO market structure and hospital performance. Our study focuses on documenting trends in hospital cost and revenue in markets with different levels of HMO market structure characteristics.

HMO Penetration

Managed care plans can reduce health care cost by affecting the price and quantity of treatment provided. Miller and Luft (1994) developed a framework for these effects: (1) increased demand-side purchasing power through selective contracting and concentrated buying power, which can lead to improved cost efficiency and lower prices, (2) use reimbursement incentives and utilization management controls to encourage lower utilization, and (3) delivery system consolidation to improve technical efficiency and economies of scale and scope. In addition, health care provider consolidation may give rise to provider countervailing power. We address this possibility by controlling for hospital market concentration in our model. The empirical literature regarding HMO penetration and hospital behavior is extensive. Most studies find greater HMO penetration being associated with equivalent or better provider performance (cost, revenue, process, outcomes) using either cross-sectional variation (Baker 1994; Gaskin and Hadley 1997; Heidenreich et al. 2002; Santerre and Adams 2002; Meara et al. 2004; Mitchell and Schlesinger 2005;) or longitudinal variation (Baker and Shankarkumar 1997; Connor, Feldman, and Dowd 1998; Bamezai et al. 1999; Hadley and Mitchell 2002; Morrisey, Jensen, and Gabel 2003; Currie and Fahr 2004; Shen and Melnick 2004; Kaestner, Dubay, and Kenney 2005; Zwanziger and Mooney 2005;), with several using instrumental variables to address potential omitted variable bias (Baker 1999; Bradford and Krumholz 2003; Shen and Melnick 2007;). However, most of the literature uses data before 2000, and as a result there is very little understanding of HMO penetration effects after 2000. More recently, Marquis, Rogowski, and Escarce (2004) document recent declines in HMO enrollment and Shen and Melnick (2007) reported that the link between high HMO penetration and hospital cost containment began to weaken in 2000. In this study, we extend the data through 2005 to explore whether the apparent weakening of the relationship between HMOs and cost containment has continued over time.

HMO Market Concentration

Another way to measure managed care effect is to capture the competitive market structure of managed care plans. Pauly (1998) posits that large health plans can exert “monopsony power” over providers to force greater price discounts and/or restrict output. We use the Herfindahl–Hirshman Index (HHI), which is a more precise measure of market concentration by taking into account both the number competitors and distribution of market share. Another advantage of using the HHI is that its longitudinal variation is more stable than the number of health plans (Scanlon et al. 2006). Recent empirical studies relating HMO market concentration to hospital performance are limited and report that HMOs in more concentrated markets have no relationship with hospital prices (Zwanziger and Mooney 2005) or cost per adjusted admission (Younis, Rivers, and Fottler 2005), are less likely to contract with safety-net hospitals (Zwanziger and Kahn 2006), and are more likely to increase the cost of treating non-HMO patients (Bradford and Krumholz 2003).

Empirically we do not expect a simple relationship between HMO concentration and hospital cost/revenue for several reasons. First, it is important to consider the interdependence of HMO penetration and HMO concentration. For example, HMO concentration effects are likely to be minimal in low HMO penetration areas because there may need to be a critical mass of HMO market share before even a monopoly HMO can influence prices and costs. Second, interaction between HMO concentration and hospital concentration may also be important. A health plan in a highly concentrated HMO market may have little leverage in a highly concentrated hospital market because these hospitals may have stronger market power compared with

hospitals in a more competitive market.

FP HMO Ownership

Microeconomic theory suggests FP organizations can achieve higher production efficiency than other forms of ownership, given the strong incentives for profitability monitored by shareholders. In addition, FP health plans often provide profit-sharing and stock options for managers and greater risk sharing with hospitals (Ahern and Molinari 2004). Some argue that FP health plans are no more effective than nonprofit plans at improving health system efficiency (Weisbrod 1988), which is empirically supported by Schramm (2001) and Town, Feldman, and Wholey (2004). Yet Wholey, Engberg, and Bryce (2006) found FP HMOs to be less productive than not-FP plans between 1985 and 2001. Shen and Melnick (2004) found that, between 1989 and 1998, hospital costs and revenues grew at a slower rate in higher FP HMO share areas, especially in high HMO penetration areas.

DATA AND METHODOLOGY

Overview

We examine hospital costs and revenues among all short-term, general, nonfederal hospitals located in metropolitan statistical areas (MSAs) in the United States, 1994–2005. Rural hospitals, which account for 15 percent of total hospital spending, are excluded because HMO variables are measured at the MSA level. In addition, we analyze price and quantity trends separately to provide further insight. We define two distinct periods: 1994–1999 and 2000–2005. We choose 2000 as the start of the second period because (1) while we recognize that HMO retrenchment did not occur evenly across markets, national HMO enrollment started to decline in 2000 (based on our data tabulation), and (2) it allows us to split the sample into two equal periods. The unit of observation is the hospital, and we include hospital and HMO market (MSA) fixed-effects to remove bias that might result from time-invariant unobserved heterogeneity across hospitals and MSAs. Our main models include all hospitals in the full sample except for Kaiser's hospitals since they do not negotiate with other health plans. We then estimate the same models separately for hospitals located in low and high HMO penetration markets, to allow for potential differential effects of FP HMO and HMO competition across different levels of HMO penetration.

Data

Hospitals utilization, costs, revenues, and other characteristics are from Medicare cost reports and the American Hospital Association (AHA) Annual Surveys. HMO penetration and concentration data were provided by Dr. Laurence Baker of Stanford University,[1] and HMO ownership data were obtained from Interstudy. Multi-hospital system data (edited) were from Drs. Kristin Madison of University of Pennsylvania and Sujoy Chakravarty of Rutgers University. Details of the system data are provided in Madison (2004) and Chakravarty et al. (2006). Lastly, MSA characteristics such as per capita income and population size are from the Area Resource File, and the area wage index is from the PPS Impact file.

Empirical Methods

The main dependent variables include the logarithm of total operating cost and net patient revenue. We use the standard translog function to account for the highly skewed distributions of the dependent variables. In our main analysis, we implement the following model:

$$\begin{aligned} LnE_{it} = {} & \alpha_i + \gamma_t + \beta(\ln(P_{it}, I_{it})) \\ & + \beta(X_{it}, HMO\_P * B_t, HMO\_C * B_t, HMO\_FP * B_t, HOP\_C_{it} * B_t) \\ & + \varepsilon_{it} \end{aligned} \quad (1)$$

where $E^*$is the annual operating costs or net patient revenue; α_i the hospital/market fixed-effects for each hospital i; γ_t the year dummies; HMO_P_{it} the overall HMO penetration rate in each year; HMO_C_{it} the HMO Herfindahl index in each year; HMO_FP_{it} the FP share of HMO enrollment in each year; HOP_C_{it} the Herfindahl index of the hospital market based on patient flow; B_t the post-2000 period indicator for years 2000–2005; P the input prices (proxy by relative wage index, log transformed); I the demand for hospital care (proxy by log per capita income); and X the hospital and market characteristics.

Year dummies capture the average growth for hospitals over the entire period. The three HMO market measures are interacted with the period dummies to assess differential effects over time. Since HMO variables are measured at the MSA level and our unit of analysis is the hospital, we adjust the standard errors of our estimates to account for the clustering at the MSA level. All other variables are measured at the hospital level.

Variable Definition

Hospital Cost and Revenue We focus on annual total operating costs and annual total net patient revenue,[2] because health plan policies have a more direct effect on operations than on nonoperating activities such as income from investments. In a descriptive exercise, we further decompose total hospital revenue into price and quantity components.

Hospital Price and Quantity Total net revenue equals average price multiplied by quantity of output. Adjusted patient days, based on AHA surveys, are used to measure hospital quantity. Since actual hospital price data are unavailable on a national basis, we constructed our statistical models to yield a proxy for price that is consistent with prior literature on measuring the price component of hospital spending (Antwi et al. 2008; Dranove et al. 2008; Dafny 2009;). To do this, we estimate equation (1) on total hospital net revenue but add adjusted patient days in the model. One key limitation to this approach is that quantity is endogenously related to HMO activities, so one should view this exercise as descriptive in nature and not an analysis that can establish causality.

HMO Penetration, Concentration, and FP Share Following others (Baker 1999; Hymen and Kovacic 2004; Shen and Melnick 2004, 2007), HMO penetration (*HMO_P*) is the share of MSA total population enrolled in HMOs in a given year. HMO concentration (*HMO_C*) is captured by a HHI using the MSA as the geographic market and by summing the squared market share of each individual HMO plan. FP share of HMO (*HMO_FP*) is the ratio of HMO enrollees in FP plans over the total number of HMO enrollees in each MSA. We estimate models on the full sample and for hospitals in low and high HMO penetration areas separately, based the average HMO penetration for the MSA over the entire time period (low HMO penetration <17 percent; high HMO penetration >25 percent).

Hospital Competition Hospital-specific geographic markets are defined using actual zip code level patient flow data, following the detailed method described in Bamezai et al. (1999). Medicare discharge data from the MEDPAR file were used to construct annual, hospital-specific HHI (*HOP_C*) based on each hospital's geographic market. The hospital HHI captures both the number of hospitals in the market as well as distribution of market share. We adjusted for hospitals that are part of multi-hospital systems with other members in the same geographic market by treating hospitals in the same system within the same geographic market as one entity instead of as competitors.

Medicare and Medicaid Financial Pressure Beginning in the early 1980s, hospitals experienced the first of a series of changes in Medicare hospital payment policy. In 1998, the Balanced Budget Act (BBA) implemented uniform rate cuts across all general acute hospitals. To capture changes in Medicare hospital payments during the study period, we construct a hospital-specific Medicare fiscal generosity variable based on previous studies (Staiger and Gaumer 1992, Cutler 1998; Shen 2003; Wu 2009;). First, Medicare fiscal pressure is calculated as the difference between a hospital's actual payments compared with the payments that it would have received under the new reimbursement method, holding the hospital's behavior constant. This measure is then weighted by a hospital's Medicare share of patients to capture the impact of Medicare reimbursement on total revenue (see Shen 2003; Wu 2009;). Lastly, we standardize the Medicare financial index so that the median hospital in each year has the

value of one—hospitals with index above one receive more generous payments from Medicare compared with the median hospital, and hospitals with index below one receive less generous payments.

For Medicaid financial pressure, we use the state-level Medicaid physician fee index from Norton and Zuckerman (2000) updated by Lewin Group (Menges et al. 2001). The index is the ratio between each state's Medicaid physician fee schedule for primary care to the corresponding Medicare physician fee, and a value above 1 indicates it is more generous than Medicare. Separately, we include the hospital's share of total patients that are Medicaid to capture the Medicaid pressure for individual hospitals.

Other Hospital and Market Controls We include case mix index (log transformed) to control for patient population's severity of illness. In addition, we include hospital ownership, hospital system membership, percent of hospital discharges that are Medicaid, percent of hospital discharges that are Medicare, percent FP, and percent government hospitals in a market.

RESULTS

Descriptive Statistics

Table 1 summarizes the study variables for all years, and separately for the two periods: 1994–1999 and 2000–2005. There are four panels in Table 1. The first panel shows means and standard deviations of key HMO and hospital market variables. The second panel includes descriptive statistics for the dependent variables: hospital operating cost and net patient revenue. The third and fourth panels summarize hospital-level and market-level control variables. We focus discussion here on the first panel: it shows that between 1994 and 1999 HMO penetration grew in most MSAs (84 percent), HMO competition increased in 68 percent of MSAs (i.e., decline in HMO Herfindahl index), and most HMO markets had stable or increased FP presence. About two-thirds of all MSAs experienced an increase in hospital market concentration. Between 2000 and 2005 the trends are very different. Almost three-quarters of MSAs had substantial declines in HMO penetration, and more than half of all MSAs (59 percent) had increased HMO concentration. FP share growth was steady, while hospital consolidation slowed over time.

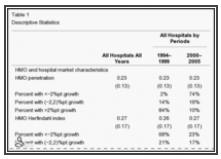

Table 1
Descriptive Statistics

Hospital Fixed-Effects Regression Results

Table 2 presents the estimated results of the key HMO variables from the hospital fixed-effects regression models for cost and revenues. To better interpret the results, we translate the regression coefficients to predicted change in cost and revenue for a 10 percentage point increase in the HMO variables in each study period. We provide complete coefficient results, including the robust standard errors for the whole sample in the Appendix SA2.

Table 2
Fixed-Effects Regression Adjusted Percentage Point Change in Operating Cost and Patient Revenue by HMO Characteristics

HMO Penetration The first column of Table 2 shows that on the whole, a 10 percentage point increase in HMO penetration is associated with a 4.1 percent reduction in hospital operating cost between 1994 and 1999. But the relationship is weaker in

2000–2005 period: the same 10 percentage point increase in penetration is only associated with a 2.5 percent reduction in operating cost (the difference between −4.1 and −2.5 is statistically significant at the 0.01 level, as shown in the Appendix SA2). The result for the earlier period is consistent with previous findings (Shen and Melnick 2007). When we allow the relationship to differ by the level of HMO penetration (columns 2 and 3 of Table 2), the association between HMO penetration and hospital cost is very strong in the high-penetration areas throughout 1994–2005 (10 percentage point increase in HMO penetration is associated with about 5 percent reduction in cost for both periods), whereas the weakening relationship post 2000 is more evident in the low HMO markets.

The same pattern of HMO penetration effects was observed in the revenue regressions: a 10 percentage point increase in HMO penetration is associated with a 4.2 percent revenue reduction in 1994–1999 but only 2.1 percent reduction in 2000–2005. Table 2 shows that of the three HMO market variables examined, penetration appeared to have the largest impact on hospital cost and revenue. To explore the relationship between HMO penetration and hospital revenue further, we decompose revenue into price and quantity. The results are presented in Table 3, which show the predicted change in price and quantity when HMO penetration increased by 10 percentage points. Since quantity is likely endogenously related to HMO penetration, the results should be interpreted with this in mind. Initially (1994–1999) HMO penetration is associated strongly with both price and quantity: a 10 percentage point increase in HMO penetration is associated with 3.7 percent reduction in price and 1.7 percent reduction in quantity. By 2000–2005, HMO's ability to influence prices appeared to disappear (predicted price change is −1.76 percent and not statistically significantly different from zero) but continued to be associated with reduced quantity (although the magnitude is slightly smaller).

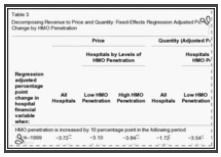

Table 3

Decomposing Revenue to Price and Quantity: Fixed-Effects Regression Adjusted Percentage Point Change by HMO Penetration

HMO Concentration As seen in Table 2, we did not find a general (linear) association between HMO HHI and hospital costs or revenues (1-plan and 2-plan concentrations were also insignificant). To explore the relationship between HMO concentration and hospital market competitiveness, we divided our hospital sample into four groups depending on the concentration of HMO and hospital markets:

We defined “HMO dominant” markets as those where the average HMO concentration is high (HMO HHI values above 0.32) and average hospital concentration is low (Hospital HHI is below 0.32). The thresholds were chosen to ensure sufficient sample in each group and the results are generally insensitive to small changes in the thresholds. We augment model (1) by adding the market indicators above along with their interaction with overall HMO penetration and period dummy (“both concentrated” markets is the reference group). We report the predicted difference in revenue and its price and quantity components comparing HMO dominant and hospital dominant markets to the reference group Table 4 (results on cost are similar to revenue and complete results on all are available upon request). The first two columns in Table 4 show that hospital revenue in HMO dominant markets is 19 percent lower than the reference markets in 1994–1999 and 27 percent lower in 2000–2005, suggesting that HMO dominant market is even stronger in containing revenue than the reference markets in the post-2000 period (the difference between 19 and 27 percent is statistically significant at 0.01 level). We observe the same pattern when analyzing separately by high and low HMO penetration. Assuming the descriptive findings on price and quantity can approximately measure HMO effects, the second and third panel of Table 4 shows that the HMO effect mainly comes from price control:

hospitals in HMO dominant markets have 23 and 29 percent lower price than the reference market in 1994–1999 and 2000–2005, respectively, while the quantity is only 10–12 percent lower.

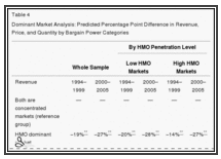

Table 4
Dominant Market Analysis: Predicted Percentage Point Difference in Revenue, Price, and Quantity by Bargain Power Categories

HMO FP Share In general, an increase in the FP HMO share does not affect changes in hospital cost or revenue (first and third column, Table 2). There is, however, a differential FP relationship by level of HMO penetration and time period. In low HMO markets, an increase in HMO FP share of 10 percentage points in the post-2000 period led to 0.4 percent reduction in cost or revenue, holding all else equal (second and fifth columns, Table 2). By contrast, in high HMO penetration markets, a 10 percentage point increase is associated with about 1 percent reduction in cost and revenue.

Limitations and Sensitivity Analyses Since we are not able to measure total system-wide spending beyond the hospital sector, our results should be interpreted with this limitation in mind. For example, to the extent that HMOs reduce hospital spending by substituting nonhospital services (such as moving surgeries to outpatient surgical centers), our estimates would overstate the net reduction in total spending associated with HMOs. Alternatively, if high HMO penetration leads to a greater reduction in the number of hospitals in high HMO markets, then our estimates of reduced expenditure per hospital will likely understate HMO induced changes to system expenditure. As a test, we included the number of hospitals in each MSA in each year in the model and the results did not vary. Third, the relationship between HMO market penetration and hospital performance might be endogenously related. For example, HMO plans might selectively enter markets where it may be easier to control future costs (e.g., high-cost provider markets). Early studies of HMO penetration used labor market characteristics to instrument for cross-sectional variations in HMO penetration (Baker 1997; Dranove et al. 2002, Bates and Santerre 2007; Shen and Melnick 2007). These measures might have been valid instruments when HMOs were still growing and employers influenced HMO adoption decisions, but current changes in HMO enrollment are more likely driven by consumer demand factors related to consumer experiences with HMOs and the HMO backlash.

Lastly, our panel data cover only HMOs and exclude PPOs. This creates potential for omitted variable bias since PPO enrollment is likely to be time-varying and our fixed-effects model would not control for such effects. In addition, there may be other time-varying omitted covariates that can bias the estimated HMO coefficients and we cannot eliminate the bias in the fixed-effects models. As such, it is important to keep in mind that our estimates do not establish a clear causality. Rather, they capture an important changing relationship between HMO market and hospital industry that might be also influenced by those time-varying unobserved confounders.

DISCUSSIONS AND CONCLUSIONS

Since 2000, health care spending has accelerated after a decade of moderate growth. Our results prior to 2000 reconfirm previous studies that show higher HMO penetration is associated with significantly reduction in hospital cost and revenue. Importantly, we find that in the latter period, the relationship appears to become weaker. To put the magnitude in context, we note that the average increase in HMO penetration rate is 7.3 percentage point between 1994 and 1999. Given the average annual hospital patient revenue of U.S. $169 million (2005 dollars) among the 2,742 hospitals in our sample, a 7.3 percentage point increase in HMO penetration would be associated with a total reduction of U.S. $14 billion among hospitals operating in MSAs.[3] However, almost three-quarters of markets experience decline in HMO penetration in 2000–2005 with average change in HMO penetration being –5.9 percentage points, rendering HMOs' ability to reduce provider cost and revenue even weaker. In fact, our results would suggest that the disenrollment from HMO is associated with a total increase of hospital revenue in the

amount of U.S. $5.6 billion.[4]

This weakening relationship between HMO penetration and hospital cost/revenue may be related to the many changes occurring in both HMO and non-HMO aspects of markets across the country. One hypothesis is that the managed care backlash has reduced the ability of HMOs to effectively control either utilization or unit prices. While our descriptive exercise on price and quantity cannot establish clear causality, the results are consistent with the hypothesis that it is the price control in particular that was weakened substantially post 2000. In addition, changes may be occurring in the non-HMO part of the market such that the differences between HMOs and other managed care plans, such as PPOs, may be not be as significant as before.

FP HMO share remains an important correlate of trends in hospital cost and revenue. We find that areas with greater FP HMO market share and higher overall HMO penetration had slower hospital cost and revenue growth throughout the study period and that post 2000, high FP share was important even in low HMO penetration areas.

Another important aspect of our study is analysis of HMO health plan market concentration. Our descriptive data indicate that HMO markets have become more concentrated over time. We find that hospital revenue in HMO-dominant markets is significantly lower than other types of markets, and the gap became wider in the post-2000 period, suggesting a slower revenue increase in HMO dominant markets. While we are unable test it directly, this finding is consistent with the hypothesis that when HMO markets are more concentrated than hospital markets, HMOs gain a bargaining advantage that results in lower hospital revenue. Furthermore, assuming that descriptive findings approximately measure HMO effects, results from the exercise on price and quantity is consistent with the hypothesis that such bargaining advantage mainly comes from price control. It will be important for future research to study the interaction and relative concentration of both industries' market structure especially given the continuing long-term trends of health insurance market consolidation, product redesign, and changes in ownership. In addition, while we adopt the commonly used competition measure, the HHI, to characterize markets, it is an imperfect measure and further work is needed to develop better measures to capture the interaction between hospital and health plan markets' relative bargaining power.

In summary, our study provides important empirical findings regarding trends in hospital cost and revenue and how they are changing in relation to important aspects of the market. However, given the many changes and increasing complexity in various aspects of health care markets, our ability to draw firm conclusions regarding underlying causes of the observed trends is limited. The level and change in HMO penetration can be correlated with other changes in the managed care industry not captured in our data. While some changes might explain why higher HMO penetration has diminishing effect on hospital costs and revenue, such as the relaxation of gate-keeping and preauthorizations and the reported broadening of provider networks, it is unclear how other changes, such as introduction of tiered provider networks and differential copay by network, and increased case management might affect the relationship between HMO penetration and hospital spending. And detailed data to measure these changes have been limited. Given the size and importance of health care spending in our economy, additional research is needed to understand how each of these aspects of the market has changed, how each should be properly measured, and how they are causally linked to spending trends.

Acknowledgments

Joint Acknowledgment/Disclosure Statement: We gratefully acknowledge funding for this research from grant 56110 under the Robert Wood Johnson Foundation's Changes in Health Care Financing and Organization (HCFO) Initiative. We thank Robert Reddick for providing the hospital competition measures; Laurence Baker for providing historical HMO penetration data; and Shoutzu Lin for excellent programming assistance. The authors do not have any conflict of interest, financial or otherwise.

Disclosures: None.

Disclaimers: None.

NOTES

[1]The underlying data sources are from Interstudy.

[2]Net patient revenue is total patient revenue minus contractual allowances and discounts on patients' accounts. Both net and total patient revenues are reported in the Medicare hospital cost reports.

[3]Since a 10 percentage point increase in HMO penetration is associated with 4.2 percent reduction in revenue, a 7.3 percentage point increase in HMO penetration is associated with $5.18 million reduction per hospital ($169 million × 0.042 × 0.73=5.18). Total reduction in revenue among all hospitals studied is $5.18 million × 2,742=$14.2 billion.

[4]A 10 percentage point increase in HMO penetration is associated with 2.06 percent reduction in revenue and the average change in HMO penetration is −5.9 percentage point. Total increase in hospital revenue=$169 million × (−0.0206) × (−0.59) × 2,742)=$5.63 billion.

SUPPORTING INFORMATION

Additional supporting information may be found in the online version of this article:

Appendix SA1: Author Matrix.

Click here to view.(83K, doc)

Appendix SA2: Hospital Fixed-Effects Regression Results on Whole Sample.

Click here to view.(24K, pdf)

Please note: Wiley-Blackwell is not responsible for the content or functionality of any supporting materials supplied by the authors. Any queries (other than missing material) should be directed to the corresponding author for the article.

Article information

Health Serv Res. Feb 2010; 45(1): 42–61.
doi: 10.1111/j.1475-6773.2009.01047.x

PMCID: PMC2813436

Yu-Chu Shen, Vivian Y Wu, and Glenn Melnick

Associate Professor of Economics, Graduate School of Business and Public Policy, Naval Postgraduate School, Naval Postgraduate School, 555 Dyer Road, Monterey, CA 93943
School of Policy, Planning, and Development, University of Southern California, Los Angeles, CA
School of Policy, Planning, and Development, University of Southern California, Los Angeles, CA
Address correspondence to Yu-Chu Shen, Ph.D., Associate Professor of Economics, Graduate School of Business and Public Policy, Naval Postgraduate School, Naval Postgraduate School, 555 Dyer Road, Monterey, CA 93943; e-mail: yshen/at/nps.edu. Vivian Y. Wu, Ph.D., is with the School of Policy, Planning, and Development, University of Southern California, Los Angeles, CA. Glenn Melnick, Ph.D., is with the School of Policy, Planning, and Development, University of Southern California, Los Angeles, CA.

REFERENCES

Ahern M, Molinari C. Impact of HMO Ownership on Management Processes and Utilization Outcomes. American Journal of Management Care. 2004;7(5):489–97. [PubMed]

Antwi Y, Gaynor M, Vogt W. *Hospital Prices in the Wake of the 1990s Merger Wave: Evidence from California*. Working Paper. Carnegie Mellon University.

Baker LC. *Does Competition from HMOs Affect Fee-for-Service Physicians*? NBER Working Paper No. 4920. Cambridge, MA: NBER.

Baker LC. The Effect of HMOs on Fee-for-Service Health Care Expenditures: Evidence from Medicare. Journal of Health Economics. 1997;16:453–81. [PubMed]

Baker LC. Association of Managed Care Market Share and Health Expenditures for Fee-for-Service Medicare Patients. JAMA. 1999;281:432–7. [PubMed]

Baker LC, Shankarkumar S. Managed Care and Health Care Expenditures: Evidence from Medicare. In: Garber AM, editor. Frontiers in Health Policy Research. Vol. 1. Cambridge: MIT Press; 1997.

Bamezai AJ, Zwanziger J, Melnick GA, Mann JM. Price Competition and Hospital Cost Growth in the United States (1989–1994) Health Economics. 1999;8(3):233–43. [PubMed]

Bates LJ, Santerre RE. Do Health Insurers Possess Monopsony Power in the Hospital Services Industry? International Journal of Health Care Financing and Economics. 2008;8:1–11. [PMC free article] [PubMed]

Bradford WD, Krumholz MH. The Effect of Managed Care Penetration on the Treatment of AMI in the Fee-for-Service Medicare Population. International Journal of Health Care Finance and Economics. 2003;2:265–83. [PubMed]

Chakravarty S, Martin G, Klepper S, Vogt W. Does the Profit Motive Make Jack Nimble? Ownership Form and the Evolution of the U.S. Hospital Industry. Health Economics. 2006;15(4):345–61. [PubMed]

Connor RA, Feldman RD, Dowd BE. The Effects of Market Concentration and Horizontal Mergers on Hospital Costs and Prices. International Journal of the Economics of Business. 1998;5(2):159–80.

Currie J, Fahr J. Hospitals, Managed Care, and the Charity Caseload in California. Journal of Health Economics. 2004;23(3):421–625. [PubMed]

Cutler DM. Cost Shifting or Cost Cutting: The Incidence of Reductions in Medicare Payments. In: Poterba JM, editor. Tax Policy and the Economy. Vol. 12. Cambridge, MA: MIT Press; 1998.

Cutler DM, Sheiner L. Managed Care and the Growth of Medical Expenditures. Forum for Health Economics & Policy. 1998;1(1):1058–1058.

Dafny L. Estimation and Identification of Merger Effects: An Application to Hospital Mergers. Journal of Law and Economics. 2009;52(3) in press.

Dranove D, Lindrooth R, White WD, Zwanziger J. Is the Impact of Managed Care on Hospital Prices Decreasing? Journal of Health Economics. 2008;27(2):362–76. [PubMed]

Dranove D, Simon CJ, White WD. Is Managed Care Leading to Consolidation in Health-Care Markets? Health Services Research. 2002;37(3):573–94. 595–609. [PMC free article] [PubMed]

Gaskin DJ, Hadley J. The Impact of HMO Penetration on the Rate of Hospital Cost Inflation, 1985–1993. Inquiry. 1997;34(3):205–16. [PubMed]

Hadley J, Mitchell JM. The Growth of Managed Care and Changes in Physicians' Incomes, Autonomy, and Satisfaction, 1991–1997. International Journal of Health Care Finance Economics. 2002;2(1):37–50. [PubMed]

Heidenreich PA, McClellan M, Frances C, Baker LC. The Relation between Managed Care Market Share and the Treatment of Elderly Fee-for-Service Patients with Myocardial Infarction. American Journal of Medicine. 2002;112(3):176–82. [PubMed]

Hymen DA, Kovacic WE. Monopoly, Monopsony, and Market Definition: An Antitrust Perspective on Market Concentration among Health Insurers. Health Affairs. 2004;23(6):25–8. [PubMed]

Kaestner R, Dubay L, Kenney J. Managed Care and Infant Health: An Evaluation of Medicaid in the US. Social Science and Medicine. 2005;60(8):1815–33. [PubMed]

Madison K. Multihospital System Membership and Patient Treatments, Expenditures, and Outcomes. Health Services Research. 2004;39:749–70. [PMC free article] [PubMed]

Marquis MS, Rogowski JA, Escarce JJ. The Managed Care Backlash: Did Consumers Vote with Their Feet? Inquiry. 2004;41:376–90.

[PubMed]

Meara E, Landrum MB, Ayanian JZ, McNeil BJ, Guadagnoli E. The Effect of Managed Care Market Share on Appropriate Use of Coronary Angiography among Traditional Medicare Beneficiaries. Inquiry. 2004;41(2):144–58. [PubMed]

Menges G, Park C, Babcock J. Comparing Physician and Dentist Fees among Medicaid Programs. Washington, DC: The Lewin Group; 2001. Available at http://www.chcf.org/documents/policy/ComparingPhysicianandDentistFees.pdfLast accessed on September 10, 2009.

Miller RH, Luft HS. Managed Care Plan Performance Since 1980. A Literature Analysis. JAMA. 1994;271(19):1512–9. [PubMed]

Miller RH, Luft HS. Does Managed Care Lead to Better or Worse Quality of Care? Health Affairs. 1997;16(5):25. [PubMed]

Miller RH, Luft HS. HMO Plan Performance Update: An Analysis of the Literature 1997–2001. Health Affairs. 2002;21(4):63–86. [PubMed]

Mitchell S, Schlesinger M. Managed Care and Gender Disparities in Problematic Health Care Experiences. Health Services Research. 2005;40(5, Part 1):1489–513. [PMC free article] [PubMed]

Morrisey MA. Competition in Hospital and Health Insurance Markets: A Review and Research Agenda. Health Services Research. 2001;36(1, Part II):191–221. [PMC free article] [PubMed]

Morrisey MA, Jensen GA, Gabel J. Managed Care and Employer Premiums. International Journal of Health Care Finance and Economics. 2003;3:95–116. [PubMed]

Norton S, Zuckerman S. Trends in Medicaid Physician Fees, 1993–1998. Health Affairs. 2000;19(4):222–32. [PubMed]

Pauly MV. Managed Care, Market Power, and Monopsony. Health Services Research. 1998;33:1439–60. [PMC free article] [PubMed]

Santerre RE, Adams AS. The Effect of Competition on Reserve Capacity: The Case of California Hospitals in the Late 1990s. International Journal of Health Care Finance and Economics. 2002;2:205–18. [PubMed]

Scanlon DP, Chernew M, Swaminathan S, Lee W. Competition in Health Insurance Markets: Limitations of Current Measures for Policy Analysis. Medical Care Research and Review. 2006;63:37S–55S. [PubMed]

Schramm C. *Blue Cross Conversion: Policy Considerations Arising from a Sale of the Maryland Plan*. The Abell Foundation Report, November.

Shen Y. The Effect of Financial Pressure on the Quality of Care in Hospitals. Journal of Health Economics. 2003;833:1–27.

Shen Y, Melnick GA. The Effects of HMO Ownership on Hospital Costs and Revenues: Is There a Difference between For-profit and Not-for-Profit Plan? Inquiry. 2004;41(3):255–67. [PubMed]

Shen Y, Melnick GA. Is Managed Care Still an Effective Cost Containment Device? accessed on September 10, 2009] *Forum for Health Economics & Policy: 9(1) (Frontiers in Health Policy Research), Article 3*. Available at http://www.bepress.com/fhep/9/1/3.

Staiger DO, Gaumer G. “Quality of Care in Hospitals: Post-admission Mortality under Medicare's Prospective Payment System.” Unpublished manuscript.

Town R, Feldman R, Wholey D. The Impact of Ownership Conversions on HMO Performance. International Journal of Health Care Finance and Economics. 2004;4(4):327–42. [PubMed]

Weisbrod BA. The Nonprofit Economy. Cambridge, MA: Harvard University Press; 1988.

Wholey DR, Engberg J, Bryce C. A Descriptive Analysis of Average Productivity among Health Maintenance Organizations, 1985 to 2001. Health Care Management Science. 2006;9(2):189–206. [PubMed]

Wu V. Managed Care's Price Bargaining with Hospitals. Journal of Health Economics. 2009;28(2):350–60. [PubMed]

Younis MZ, Rivers PA, Fottler MD. The Impact of HMO and Hospital Competition on Hospital Costs. Journal of Health Care Finance. 2005;31:4. [PubMed]

Zwanziger J, Kahn N. Safety-Net Activities and Hospital Contracting with Managed Care organizations. Medical Care Research and Review. 2006;63(6):90S–110S. [PubMed]

Zwanziger J, Mooney C. Has Competition Lowered Hospital Prices? Inquiry. 2005;42(1):73–85. [PubMed]